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Mochizuki

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(54) **GROMMET HAVING A RESILIENT FLANGE**

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(73) Assignee: **Yazaki Corporation**, Tokyo (JP)

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(56) **References Cited**

U.S. PATENT DOCUMENTS

3,243,835	*	4/1966	Armentrout	16/2.1
5,280,138	*	1/1994	Preston	174/152 G
5,360,945	*	11/1994	Truesdale	174/65 R
5,631,447	*	5/1997	Smith	174/260
6,058,562	*	5/2000	Satou	16/2.1

FOREIGN PATENT DOCUMENTS

0 888 931 A2	1/1999	(EP) .
8-212857	8/1996	(JP) .
10-261334	9/1998	(JP) .

OTHER PUBLICATIONS

Japanese Abstract of 07296659, Nov. 10, 1995.
Japanese Abstract of 11166669, Jun. 22, 1999.
Japanese Abstract of 09117040, May 2, 1997.

* cited by examiner

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(57) **ABSTRACT**

A grommet is provided for positively mounting a long member (e.g. a wire harness) in such a manner that the long member is passed through a mounting plate such as a panel of a vehicle body. A grommet for passing and holding a wire harness relative a mounting hole formed through a mounting plate includes a first cylindrical portion for passing the wire harness therethrough, a second cylindrical portion connected to the first cylindrical portion through a connection portion, a groove formed in an outer peripheral surface of the second cylindrical portion, and a flange portion formed on that portion of the outer peripheral surface of the second cylindrical portion lying between the groove and the connection portion. A plurality of guide portions, extending radially from the outer peripheral surface of the first cylindrical portion, are brought into contact with an inner peripheral edge of the mounting hole in such a manner that the second cylindrical portion is disposed coaxially with the mounting hole.

8 Claims, 12 Drawing Sheets

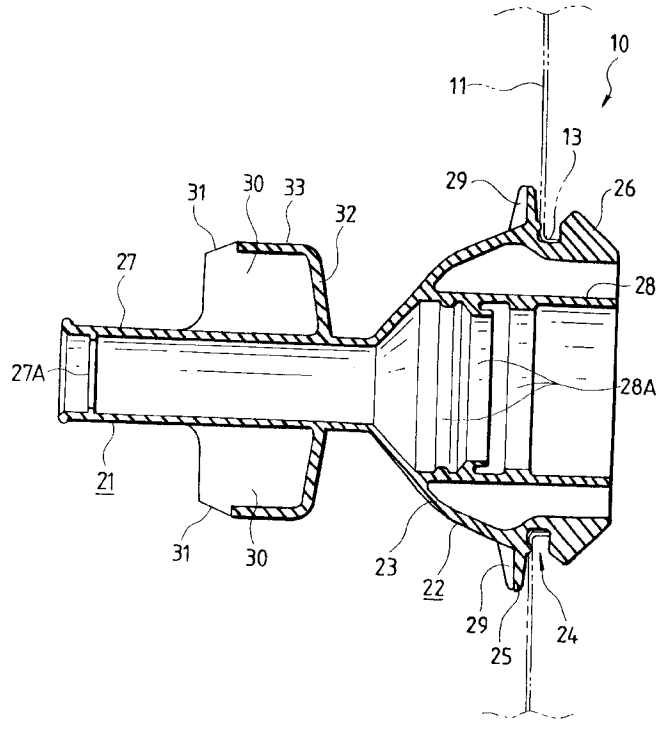

FIG.1(B)

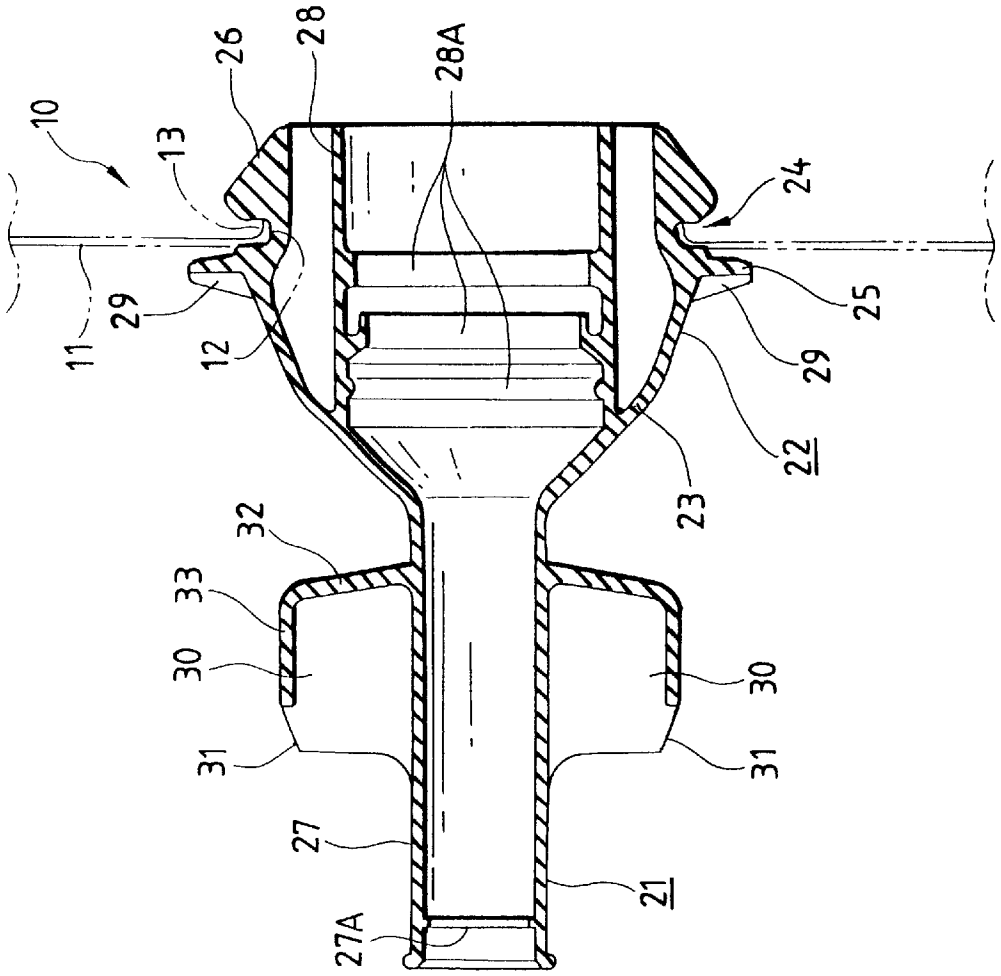
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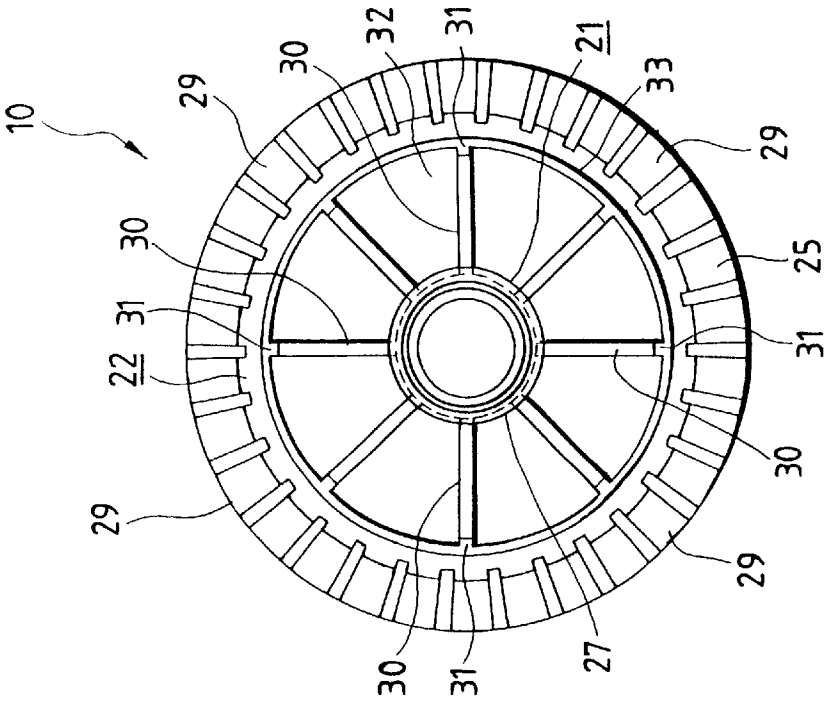
FIG.1(A)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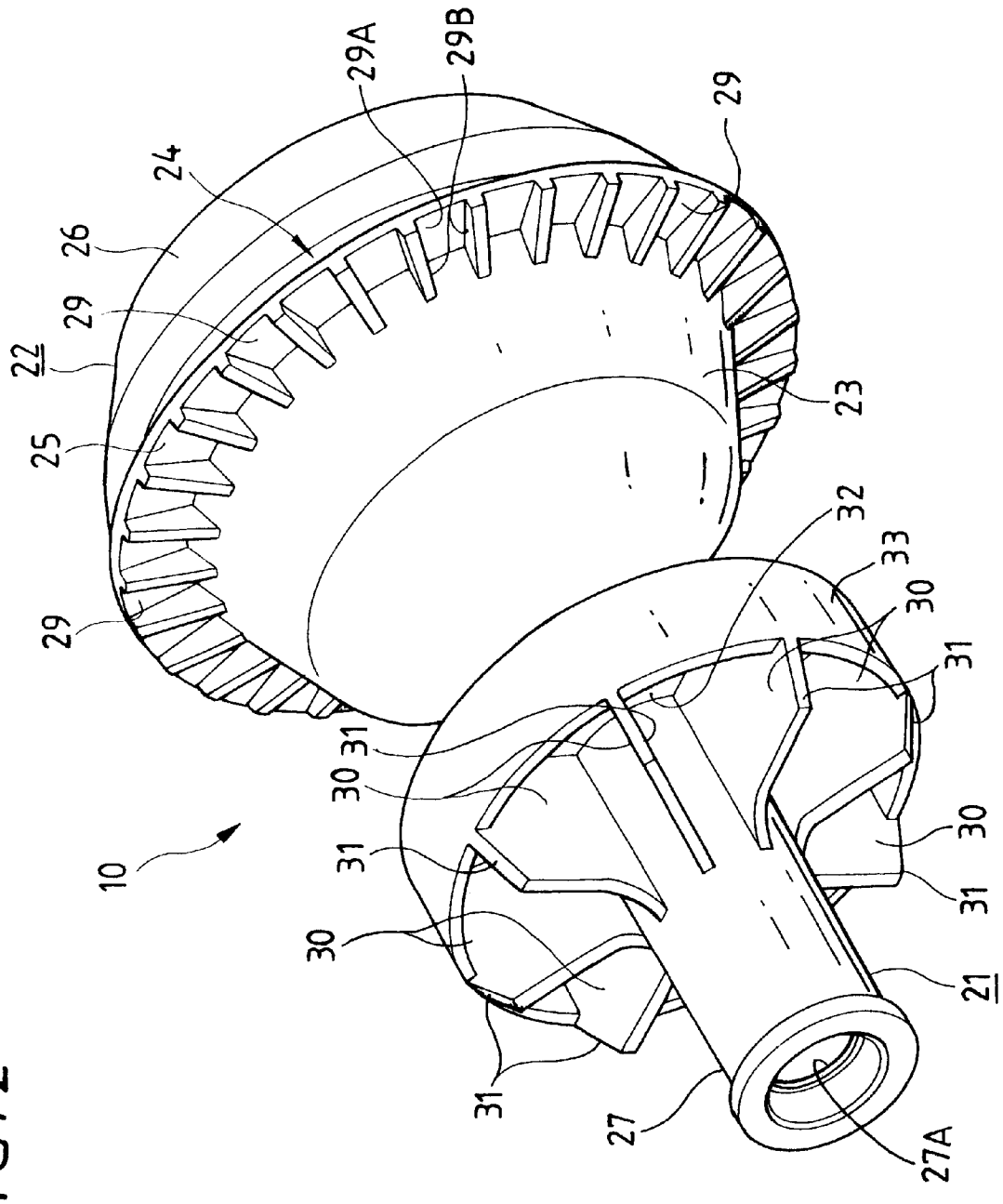
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FIG. 2

FIG.3

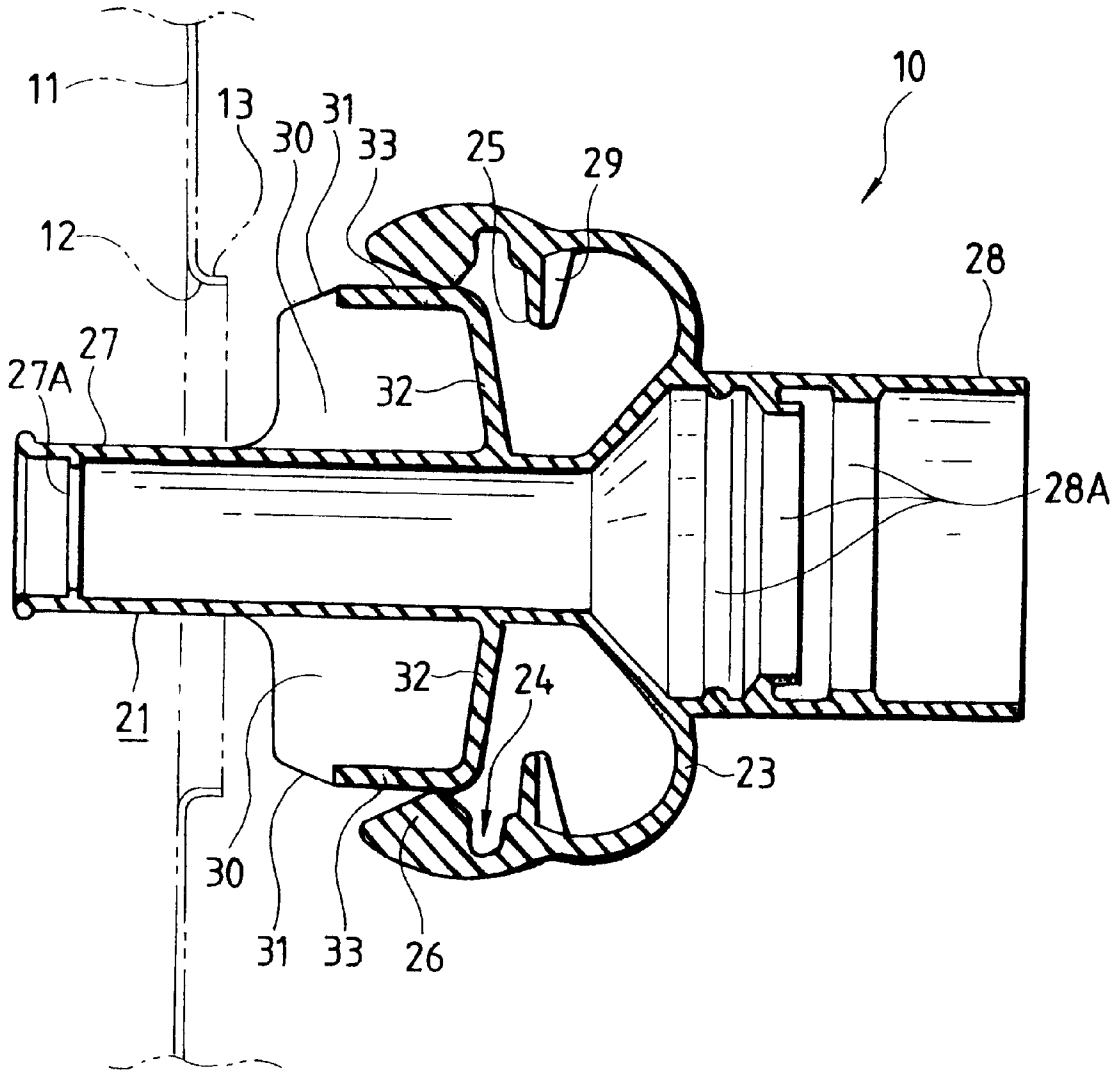

FIG.4

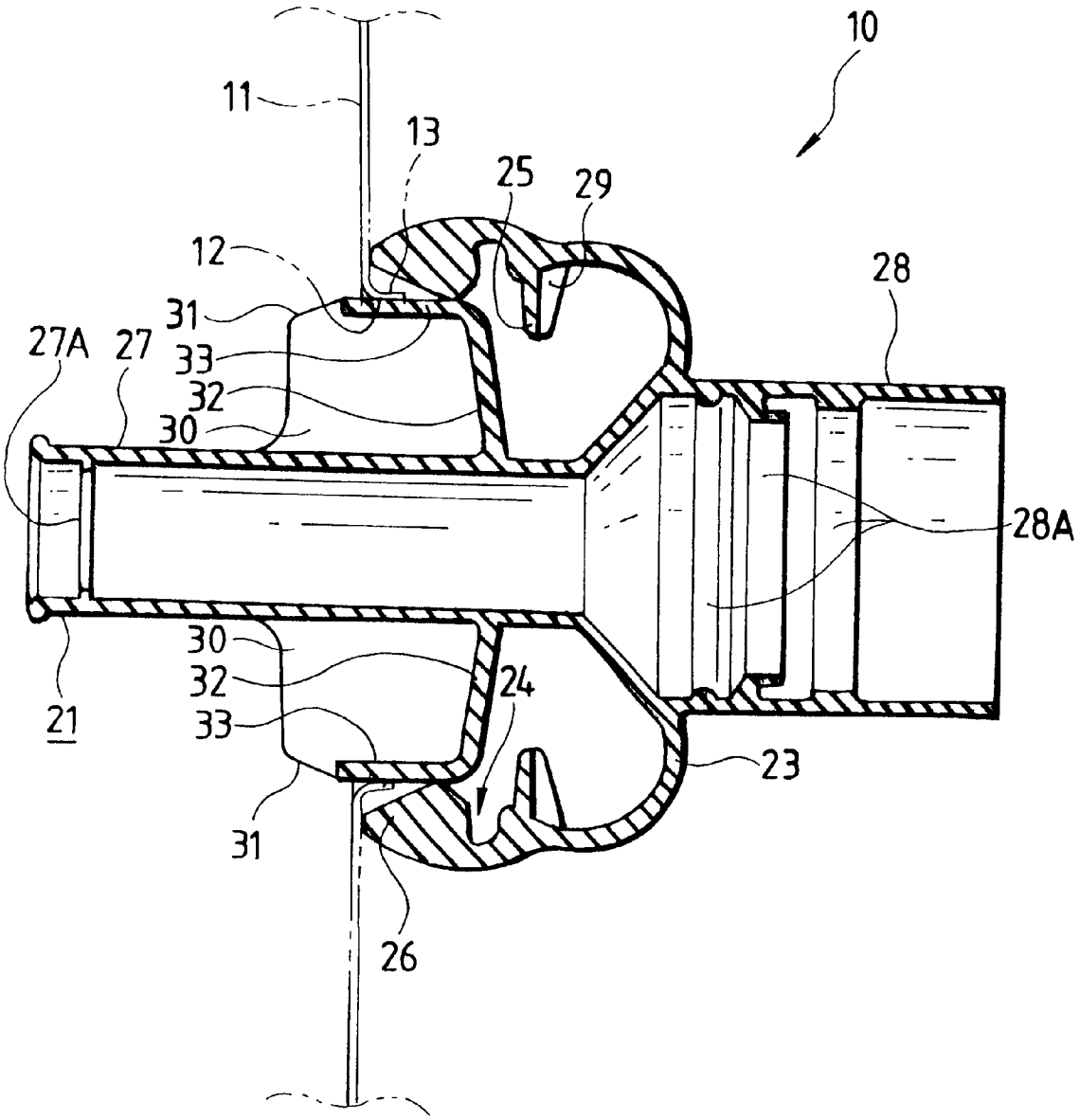

FIG. 5

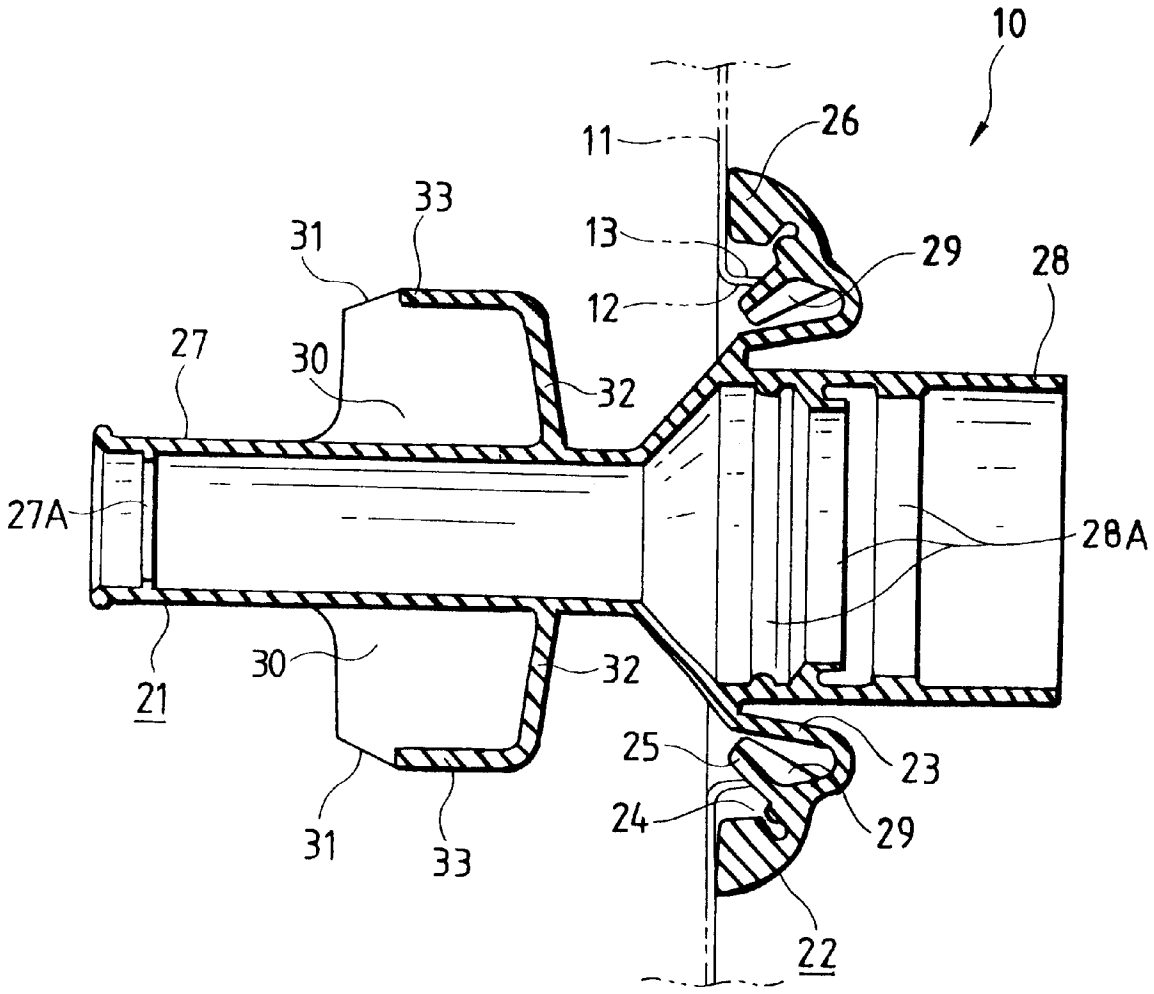
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FIG. 6

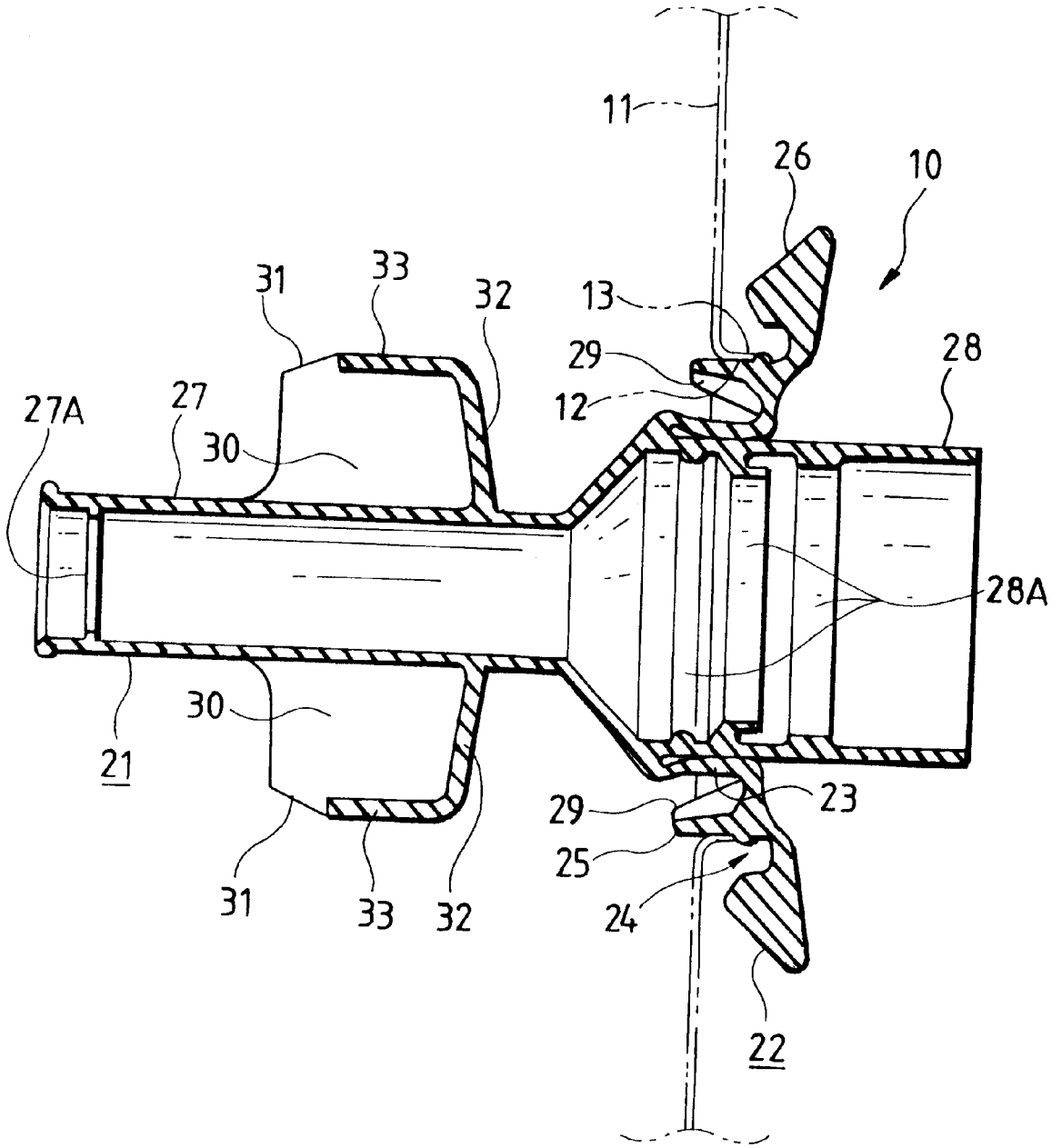
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FIG. 7

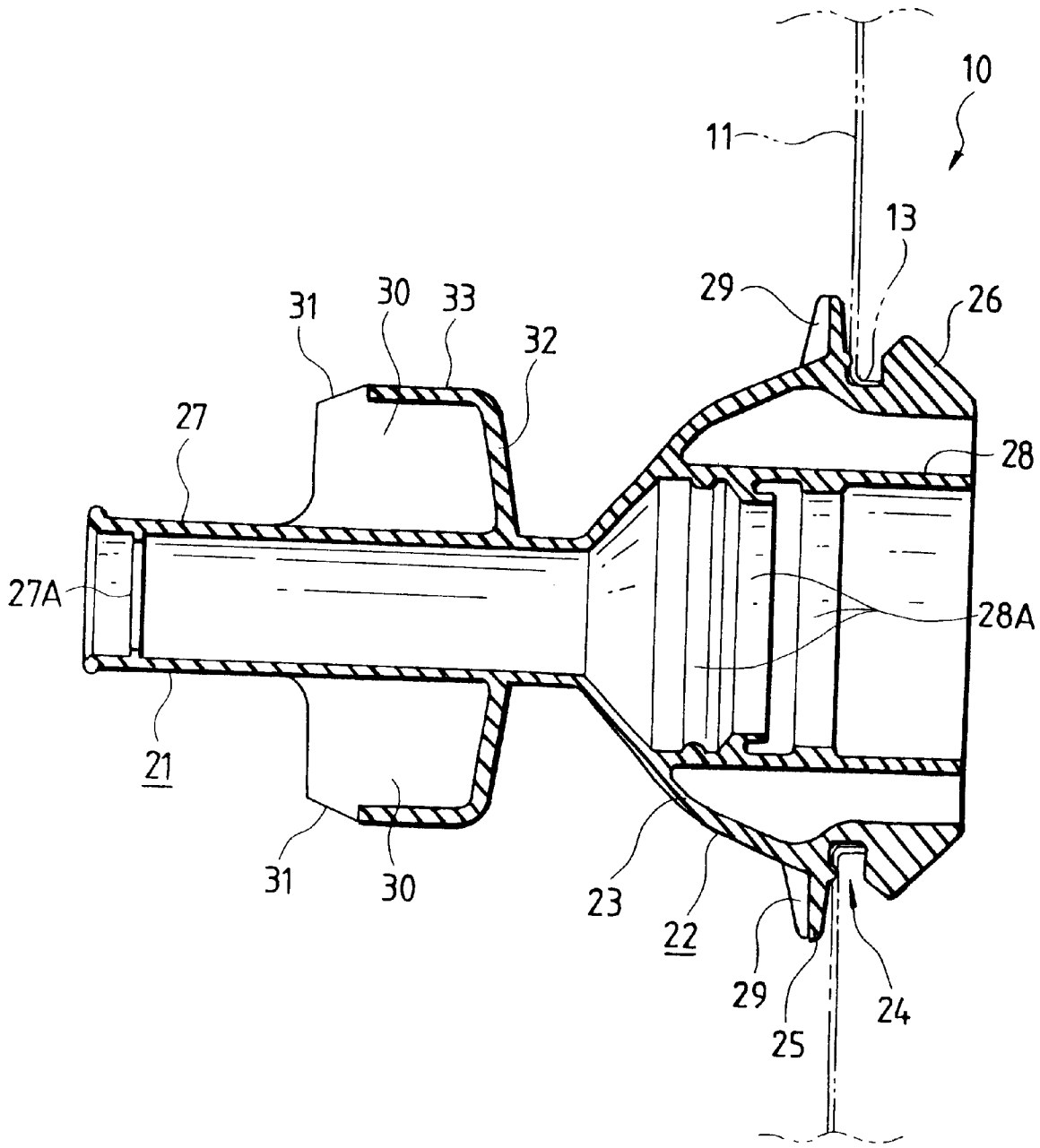
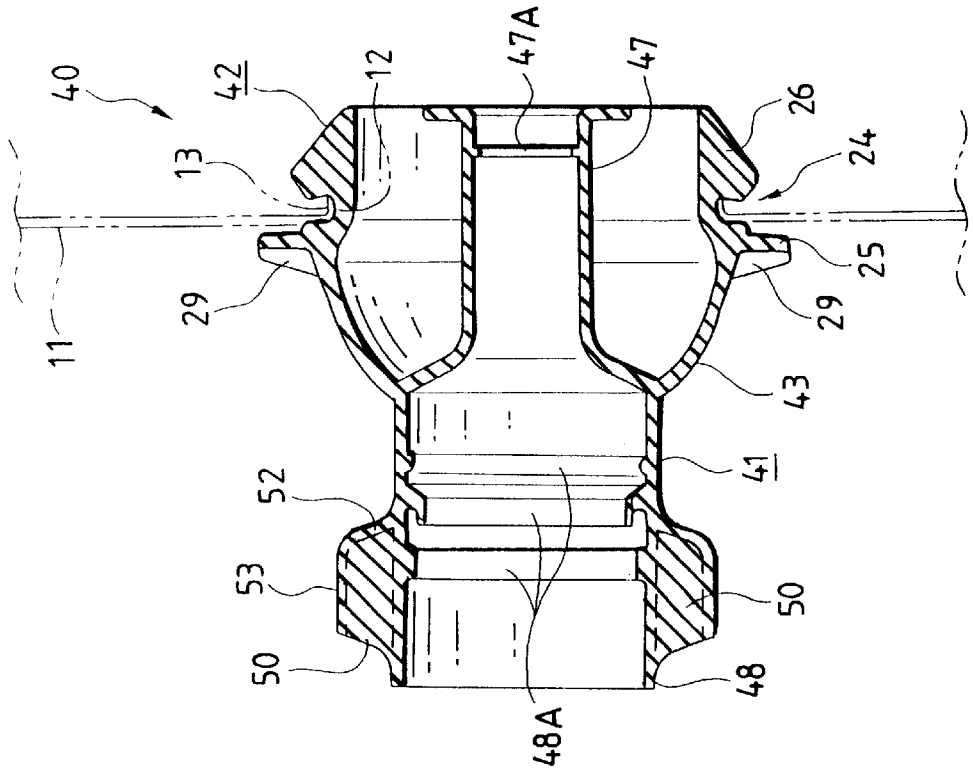


FIG.8(B)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48A

FIG.8(A)

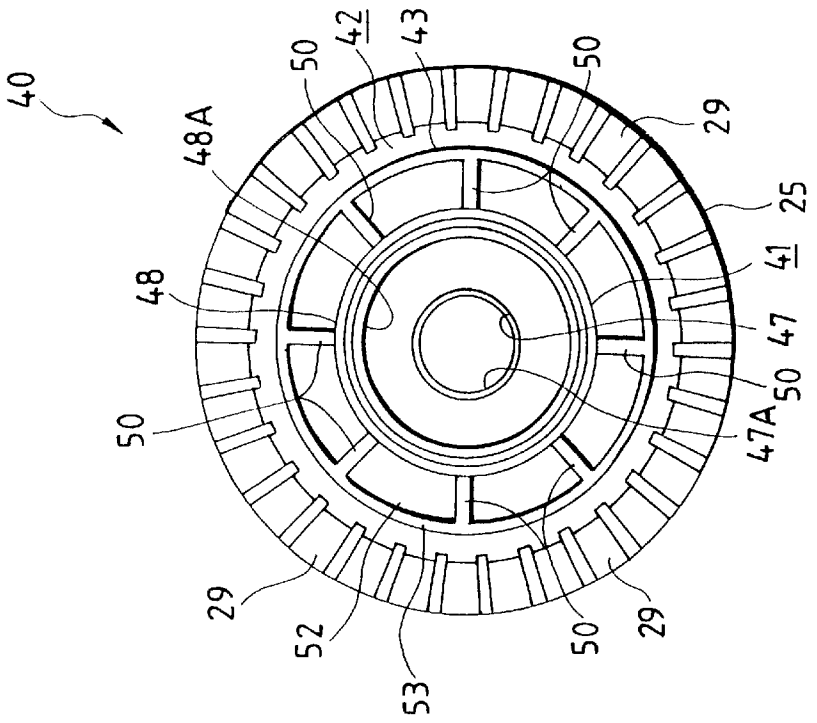
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FIG.9

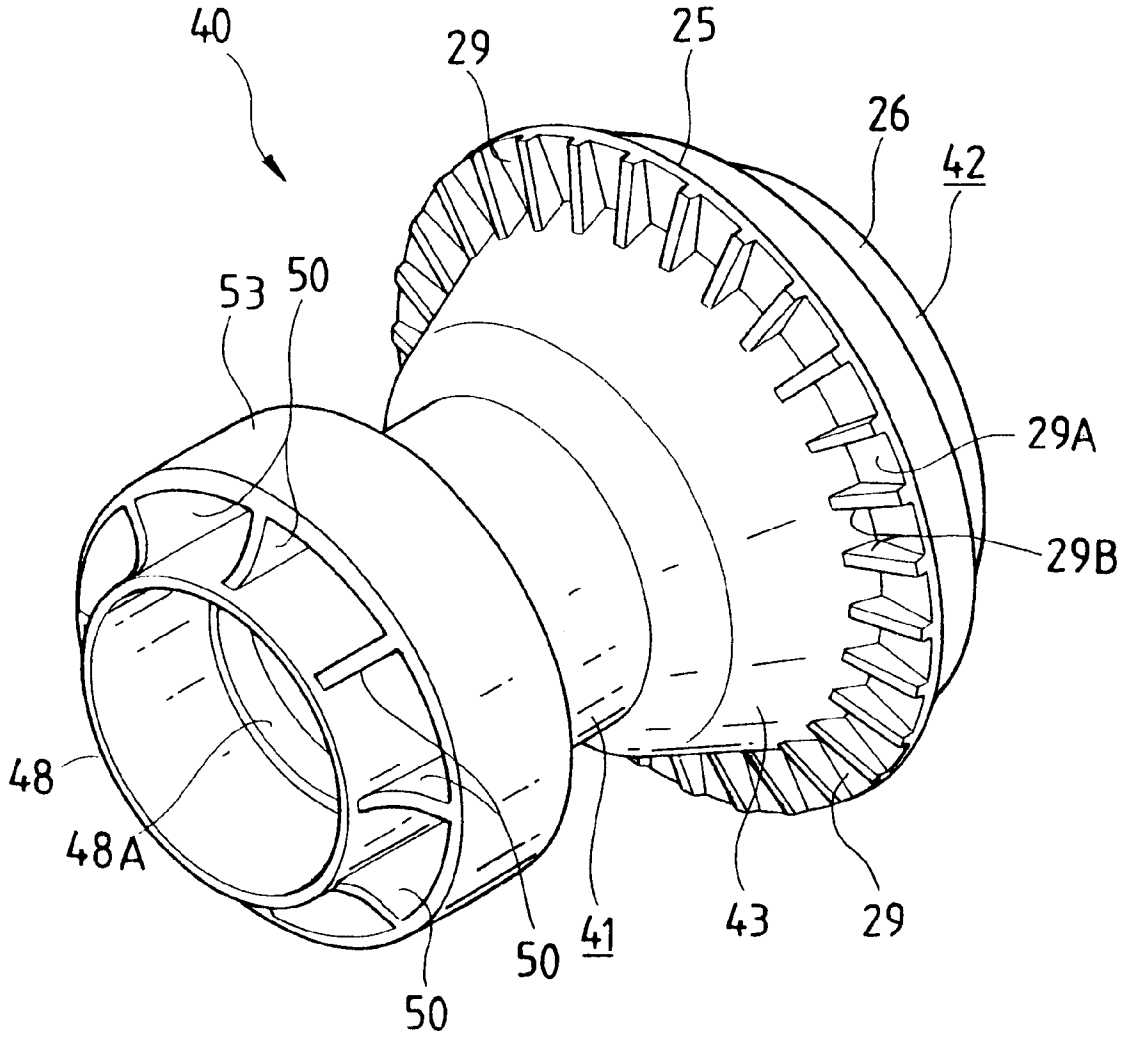
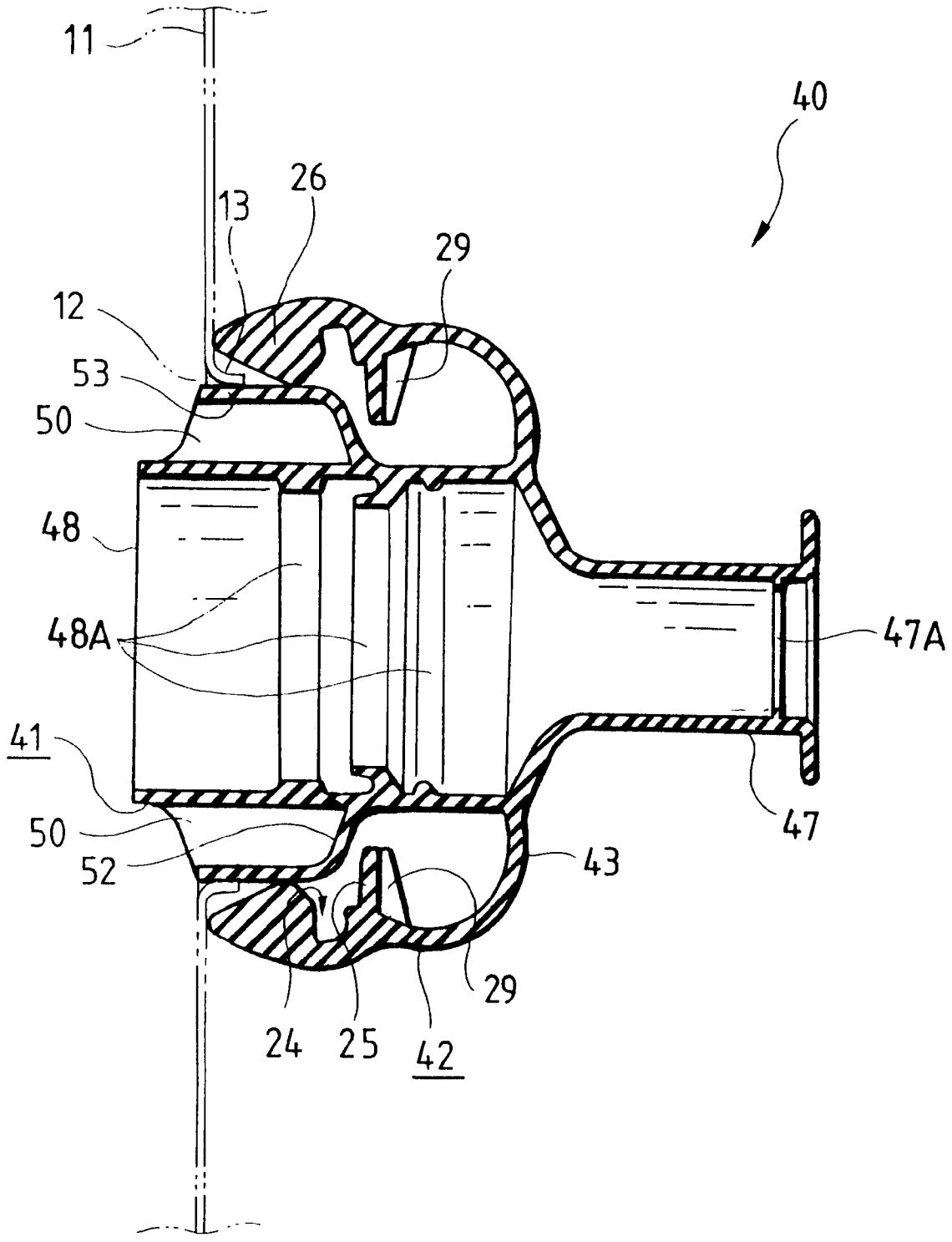


FIG.10



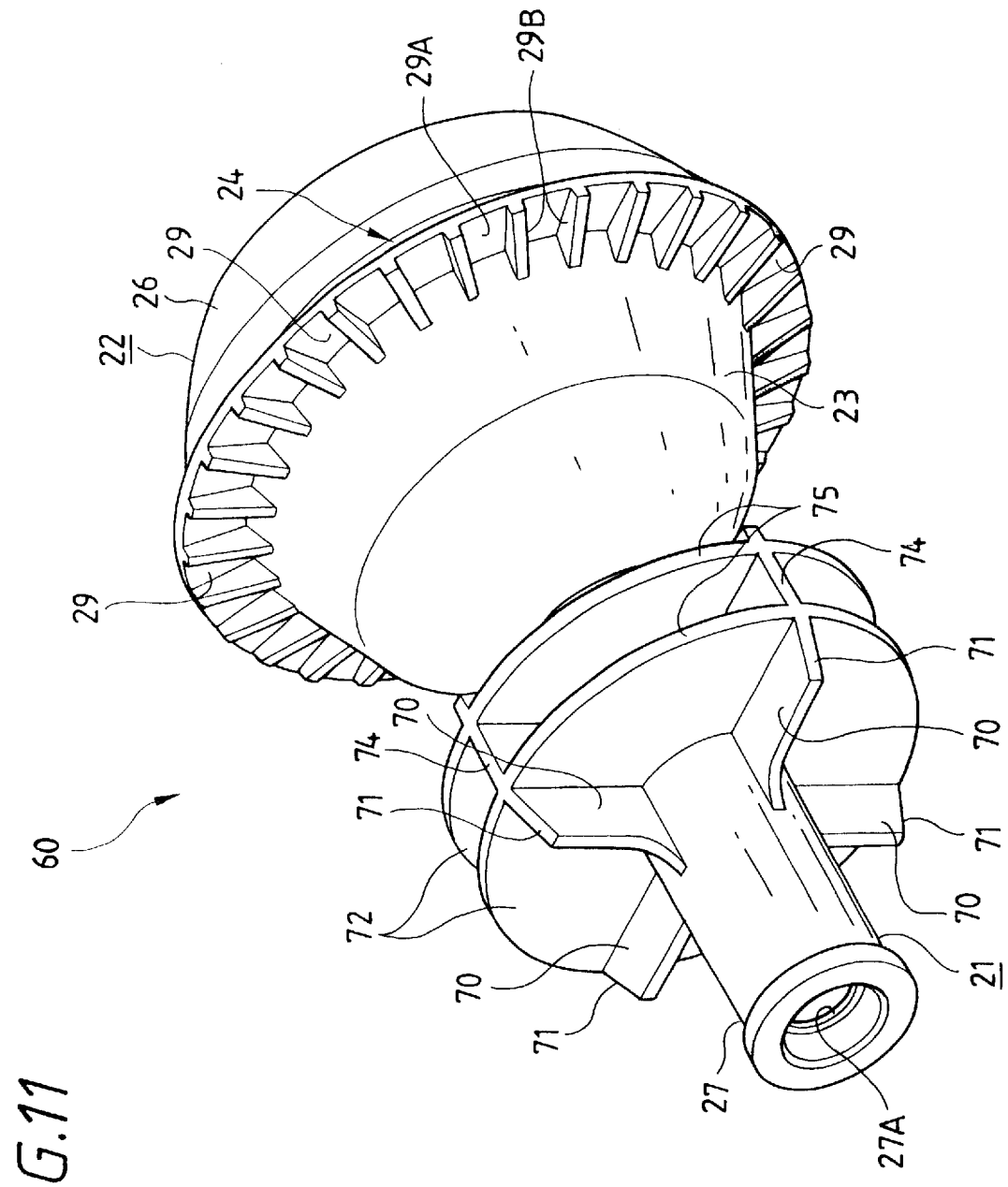

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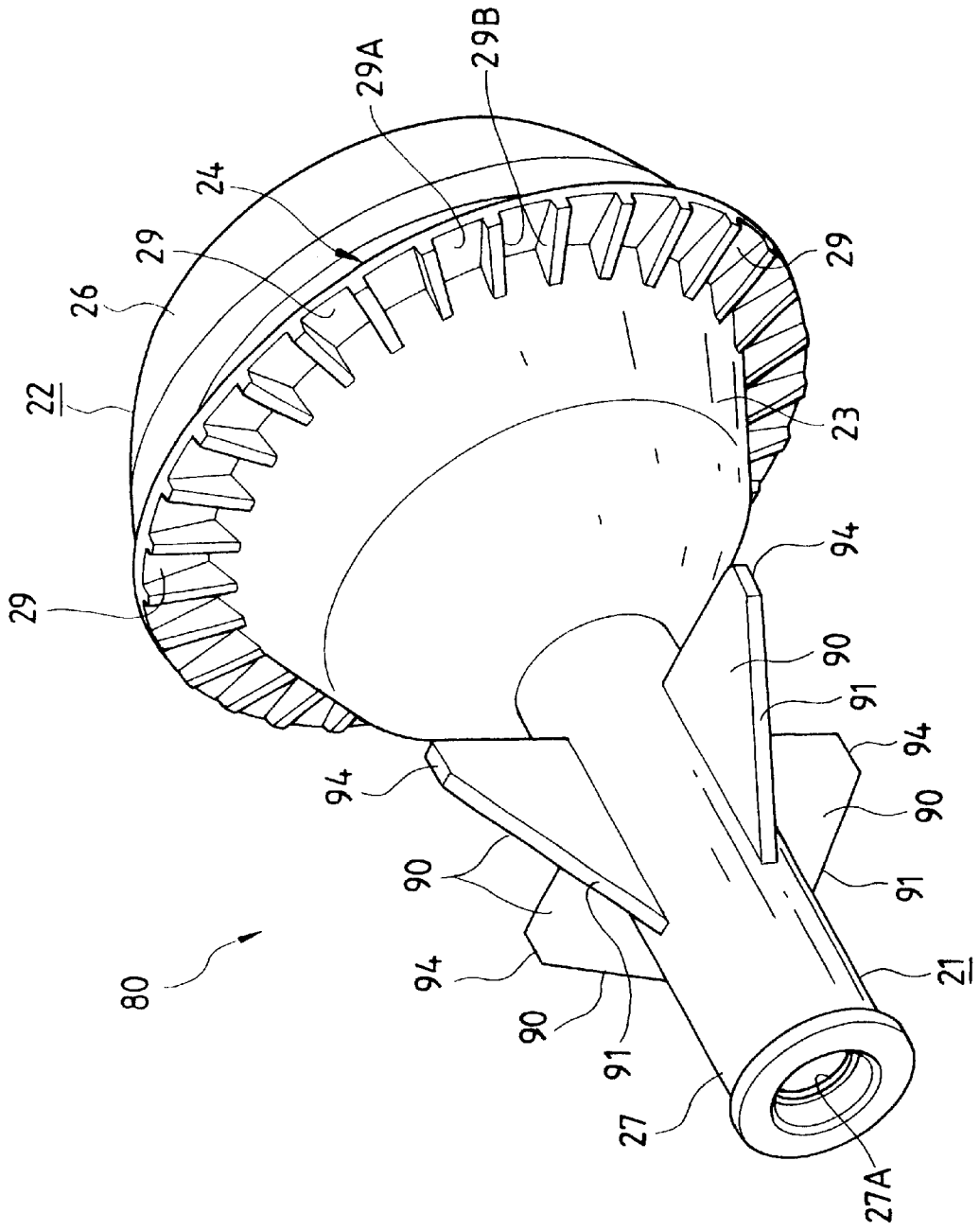
FIG.11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27A
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FIG.12

GROMMET HAVING A RESILIENT FLANGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a grommet, and more particularly to a grommet which enables a long member (e.g. a wire harness) to be positively and easily passed through and retained to a mounting plate such as a panel of a vehicle body.

2. Related Art

There have heretofore been proposed various grommets which enable a wire harness to be passed through and mounted on a panel of a car body of an automobile, and the Applicant of the present application has proposed a grommet (Japanese Patent Unexamined Publication No. 8-212857) which includes a smaller-diameter tubular portion for fitting on a wire harness, a larger-diameter tubular portion for fitting in a mounting hole, a tapering tubular portion interconnecting the smaller-diameter and larger-diameter tubular portions, and a groove edge portion and a holding piece portion which are provided at an outer peripheral surface of the larger-diameter tubular portion.

In this example, the larger-diameter tubular portion is turned inside out, with its inner peripheral surface directed outwardly, and by doing so, a peripheral edge portion of the holding piece portion is deformed into a tapering, cylindrical shape, and is passed through the mounting hole. Subsequently, the smaller-diameter portion is drawn into the mounting hole, and as a result, because of a resilient force tending to restore the holding piece into its initial shape, the larger-diameter portion is restored into its initial shape in such a manner that the groove edge portion is engaged in a peripheral edge of the mounting hole. Therefore, the wire harness can be easily and positively mounted with a relatively smaller force than other conventional grommets.

In the above conventional example, if the smaller-diameter portion is passed through the mounting hole with its axis disposed out of alignment with the axis of the mounting hole, when mounting the wire harness, there is a possibility that the groove is ill-fitted to the mounting hole so as to be in eccentric relation to the peripheral edge of this mounting hole.

Therefore, it has been desired to provide the type of grommet which enables the groove to be positively and easily fitted to the mounting hole in a proper condition.

SUMMARY OF THE INVENTION

This invention has been made in view of the above problems, and an object of the invention is to provide a grommet for positively mounting a longitudinally shaped member (e.g. a wire harness) in such a manner that the long member is passed through a mounting plate such as a panel of a vehicle body.

According to the invention, the above object has been achieved by a grommet for passing and holding a member relative to a mounting hole formed through a mounting plate, which comprises a first cylindrical portion for passing the member therethrough, a second cylindrical portion connected to the first cylindrical portion through an annular connection portion formed on an outer peripheral surface of the first cylindrical portion, a groove portion formed in an outer peripheral surface of the second cylindrical portion, and a flange portion formed on that portion of the outer peripheral surface of the second cylindrical portion lying between the groove portion and the connection portion. The second cylindrical portion is turned inside out, with its inner peripheral surface directed outwardly, so that a peripheral edge portion of the flange portion is inserted into the mounting hole, and then the second cylindrical portion is restored into its initial shape, so that the first cylindrical portion is passed through the mounting hole, and the groove portion is fitted on an inner peripheral edge of the mounting hole. A plurality of guide portions extend radially from the outer peripheral surface of the first cylindrical portion and the guide portions can be brought into contact with the inner peripheral edge of the mounting hole in such a manner that the second cylindrical portion is disposed coaxially with the mounting hole.

The first cylindrical portion need only to have an inner diameter corresponding to an outer diameter of the member such as a wire harness, and this inner diameter may be a little smaller so that the member can be press-fitted into the first cylindrical portion. This first cylindrical portion does not need to have a uniform inner diameter or a uniform outer diameter over the entire length thereof, and for example may a stepped, cylindrical shape or a tapering, cylindrical shape.

The connection portion need only to radially extend from the predetermined portion of the outer peripheral surface of the first cylindrical portion over the entire circumference thereof, and for example, this connection portion is formed into a flat ring-shape or a generally conical shape.

The second cylindrical portion need only to have an outer diameter corresponding to the inner diameter of the mounting hole, and the proximal end of this second cylindrical portion is connected to the peripheral edge of the connection portion.

Therefore, for example, the first cylindrical portion and the second cylindrical portion may be arranged in a telescopic manner, or may be serially arranged in the axial direction through the connection portion.

The first cylindrical portion, the connection portion and the second cylindrical portion may be formed integrally with one another, using a synthetic resin having a suitable degree of elasticity and water resistance. However, these portions may be separate from each other in so far as the second cylindrical portion can have a suitable degree of elasticity and water resistance.

The flange portion may comprise an annular flange, formed on the outer peripheral surface of the second cylindrical portion over the entire circumference thereof, or may comprise a plurality of flange portions spaced a predetermined distance from one another in the circumferential direction.

Each of the guide portions may comprise a plate disposed parallel to the axis of the first cylindrical portion, or may comprise a plate or a bar extending radially of the first cylindrical portion. These guide portions have the same length in the radial direction, and are arranged at equal intervals or unequal intervals in the circumferential direction.

In the grommet of this construction, when the plurality of guide portions, extending radially from the outer peripheral surface of the first cylindrical portion, are brought into contact with the inner peripheral edge of the mounting hole, the second cylindrical portion is disposed coaxially with the mounting hole, and therefore the groove portion is fitted properly to the mounting hole, and more specifically, the inner peripheral edge of the mounting hole, and therefore the above object is achieved.

In the present invention, if each of the guide portions has a plate-like shape, and is disposed parallel to the axis of the

first cylindrical portion, the required strength can be obtained as compared with the case where each guide portion comprises a plate or a bar extending radially of the first cylindrical portion, and therefore the guide portions can positively guide the first cylindrical portion without being easily deformed.

In the present invention, if the guide portions are interconnected through a disk portion, corresponding to the mounting hole, or if the guide portions are interconnected through an annular portion, having a diameter corresponding to the diameter of the mounting hole, the strength of the guide portions can be further increased.

In the present invention, if the guide portions are tapering toward the open end of the first cylindrical portion, the guide portions can be easily inserted into the mounting hole.

In the present invention, an engagement portion may be formed on the outer peripheral surface of the second cylindrical portion, and tapered from the groove portion to the distal end of the second cylindrical portion.

In this grommet, the engagement portion, tapering from the groove portion toward the distal end, is formed beforehand, and therefore when the second cylindrical portion is inverted, the engagement portion tapers from the end of the inner peripheral surface in the axial direction.

Therefore, for example, in the case where a flange is formed on the peripheral edge portion of the mounting hole, the axis of the mounting hole is substantially aligned with the axis of the second cylindrical portion by the engagement portion when the inverted second cylindrical portion is fitted on this flange, and therefore the groove portion can be uniformly fitted in the inner peripheral edge of the mounting hole.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**(A) and **1**(B) are a plan view and a cross-sectional view, respectively, of a grommet of a first embodiment;

FIG. **2** is a perspective view showing the grommet of the first embodiment;

FIG. **3** is a cross-sectional view showing the initial procedure of mounting the grommet of the first embodiment;

FIG. **4** is a cross-sectional view showing the procedure of mounting the grommet of the first embodiment;

FIG. **5** is a cross-sectional view showing the procedure of mounting the grommet of the first embodiment;

FIG. **6** is a cross-sectional view showing the procedure of mounting the grommet of the first embodiment;

FIG. **7** is a cross-sectional view showing the mounting the grommet of the first embodiment;

FIGS. **8**(A) and (B) are a plan view and a cross-sectional view, respectively, of a grommet of a second embodiment;

FIG. **9** is a perspective view showing the grommet of the second embodiment;

FIG. **10** is a cross-sectional view showing the procedure of mounting the grommet of the second embodiment;

FIG. **11** is a perspective view showing the grommet of a third embodiment; and

FIG. **12** is a perspective view showing the grommet of a fourth embodiment.

DETAILED DESCRIPTION OF THE INVENTION

Embodiments of the present invention will now be described in detail with reference to the drawings. FIGS. **1**(A) and (B) are a plan view and a cross-sectional view of a first embodiment of a grommet of the present invention, FIG. **2** is a perspective view showing the whole of the grommet of the first embodiment, FIGS. **3** to **7** are cross-sectional views showing the procedure of mounting the grommet of the first embodiment, FIGS. **8**(A) and (B) are a plan view and a cross-sectional view of a second embodiment of a grommet of the invention, FIG. **9** is a perspective view showing the whole of the grommet of the second embodiment, FIG. **10** is a cross-sectional view showing the procedure of mounting the grommet of the second embodiment, FIG. **11** is a perspective view showing the whole of a grommet of a third embodiment, and FIG. **12** is a perspective view showing the whole of a grommet of a fourth embodiment.

As shown in FIGS. **1**(A), **1**(B) and **2**, in order that awire harness (not shown) can be passed through and mounted on a car body panel **11** of an automobile, the grommet **10**, according to the first embodiment of the present invention, can be fitted in a mounting hole **12**, formed through the car body panel **11**, with the wire harness passed through and held by this grommet. The mounting hole **12** has a circular shape, and a flange **13** of a predetermined height is formed on a peripheral edge of this mounting hole **12**.

The grommet **10** includes a first cylindrical portion **21** for passing the wire harness therethrough, an annular connection portion **23** formed on an outer peripheral surface of the first cylindrical portion **21**, a second cylindrical portion **22** connected to the first cylindrical portion **21** through the connection portion **23**, a groove **24** formed in an outer peripheral surface of the second cylindrical portion **22**, a flange portion **25** formed on that portion of the outer peripheral surface of the second cylindrical portion **22** lying between the groove **24** and the connection portion **23**, and a tapering engagement portion **26** formed on that portion of the outer peripheral surface of the second cylindrical portion **22** extending from the groove **24** to an open end of the second cylindrical portion **22**.

The grommet **10** is made of a synthetic resin having a suitable degree of elasticity and water resistance, and the first cylindrical portion **21** and the second cylindrical portion **22** are formed integrally with each other.

The first cylindrical portion **21** is formed into a stepped configuration, and has a smaller-diameter portion **27** and a larger-diameter portion **28** which are continuous with each other along a common axis.

The smaller-diameter portion **27** has an inner diameter corresponding to the outer diameter of the wire harness, and an annular rib **27**A is formed on an inner peripheral surface thereof.

When the wire harness is press-fitted into the smaller-diameter portion **27**, the rib **27**A is elastically deformed, and is held in intimate contact with the outer peripheral surface of the wire harness, so that the smaller-diameter portion **27** holds the wire harness in an airtight manner.

The larger-diameter portion **28** has an inner diameter larger than the inner diameter of the smaller-diameter portion **27**, and a plurality of annular ribs **28**A are formed on an inner peripheral surface of the larger-diameter portion **28**.

After the wire harness is press-fitted into the grommet, a predetermined filler is filled in the larger-diameter portion **28**, and is solidified, so that the larger-diameter portion **28** holds the wire harness in an airtight manner.

The connection portion **23** is formed into a generally conical shape spreading from the boundary between the smaller-diameter portion **27** and the larger-diameter portion **28** toward the open end of the larger-diameter portion **28**.

The second cylindrical portion **22** has an outer diameter corresponding to the diameter of the mounting hole **12**, and has an inner diameter larger than the outer diameter of the larger-diameter portion **28**, and this second cylindrical portion **22** is connected to the connection portion **23**. Therefore, the larger-diameter portion **28** is provided within the second cylindrical portion **22** in generally telescopic relation thereto, with a predetermined space formed therebetween.

The groove **24** for fitting on the flange **13** of the mounting hole **12** has a generally channel-shaped cross-section, and is formed over the entire circumference of the second cylindrical portion **22**, and is disposed in a plane perpendicular to the axis of the second cylindrical portion **22**.

The flange portion **25** has a diameter larger than the diameter of the mounting hole **12**, and is formed adjacent to the groove **24** over the entire circumference of the second cylindrical portion **22**, and is disposed in a plane perpendicular to the axis of the second cylindrical portion **22**. The flange portion **25** has a plurality of radially-extending recesses **29** arranged on the conical surface extending toward the connection portion **23**, and has a generally differential gear-shape (see FIG. **2**).

Each recess **29** has a generally rectangular cross-section (see FIG. **3**), and is defined by a bottom surface **29**A and a pair of adjacent wall surfaces **29**B, **29**B disposed perpendicular to the bottom surface **29**A.

The engagement portion **26** is formed over the entire circumference of the second cylindrical portion **22**, and is disposed in a plane perpendicular to the central axis of the second cylindrical portion **22**. This engagement portion **26** is formed into a generally conical shape.

According to the present invention, this grommet **10** has eight guide portions **30** extending radially outwardly from the outer peripheral surface of the first cylindrical portion **21**. Each of the guide portions **30** has a plate-like shape, and is disposed on a plane so as to be parallel to the central axis of the first cylindrical portion **21**. The guide portions **30** are spaced 45 degrees from one another in the direction of the circumference of the first cylindrical portion **21**, and have respective chamfered portions **31** tapering or slanting toward the open end of the first cylindrical portion **21**.

These guide portions **30** each have the same length in the radial direction, and are interconnected through a disk portion **32** and an annular portion **33** having diameters which correspond to the diameter of the mounting hole **12**. When the guide portions **30** are brought into contact with the inner peripheral edge of the mounting hole **12** through the annular portion **33**, the second cylindrical portion **22** is disposed coaxially with the mounting hole **12**.

Next, the procedure of mounting the wire harness by the use of this grommet **10** will be described.

First, the wire harness is passed through the first cylindrical portion **21** of the grommet **10**, and the predetermined filler is filled in the larger-diameter portion **28**, and is solidified.

Then, as shown in FIG. **3**, the second cylindrical portion **22** is turned inside out relative to the first cylindrical portion **21** at the portion adjacent to the connection portion **23**, so that the inner peripheral surface of the second cylindrical portion **22** is directed outwardly, and also the flange portion **25** is reduced in diameter, with its peripheral edge directed inwardly.

As shown in FIG. **2**, the flange portion **25** has an initial shape so that the bottom surface **29**A is disposed perpendicular to the wall surfaces **29**B and **29**B. However, as the inversion of the second cylindrical portion **22** proceeds, the bottom surface **29**A is curved or deformed, so that the wall surfaces **29**B and **29**B move toward each other, and as a result, regular radial wrinkles are formed on this flange portion, and this flange portion is reduced in diameter.

As the inversion of the second cylindrical portion **22** proceeds, the inner peripheral surface thereof, which is originally the outer peripheral surface, is tapered from its open end toward the connection portion **23** because of the provision of the engagement portion **26**, and the engagement portion **26** is brought into contact with the annular portion **33**.

Then, as shown in FIG. **4**, the first cylindrical portion **21** are brought into contact with the inner peripheral edge of the mounting hole **12** through the annular portion **33**.

At this time, since the guide portions **30** are tapered due to the provision of the chamfered portions **31**, the guide portions **30** are guided into contact with the inner peripheral edge of the mounting hole **12**, so that the first cylindrical portion **21** is positively disposed coaxially with the mounting hole **12**.

The engagement portion **26** of the second cylindrical portion **22** is already held in contact with the annular portion **33**, and therefore, when the first cylindrical portion **21** is moved axially with the outer peripheral surface of the annular portion **33** held in sliding contact with the inner peripheral edge of the mounting hole **12**, the engagement portion **26** and the annular portion **33** are so arranged that the flange **13** is interposed therebetween.

Therefore, the second cylindrical portion **22** is also disposed coaxially with the mounting hole **12**.

Thereafter, in a condition in which the open end of the second cylindrical portion **22** is held against the car body panel **11**, the wire harness (not shown) is pulled relative to the car body panel **11** in a left-hand direction (in reference to the drawings), thereby withdrawing the guide portions **30** from the mounting hole **12** while deforming the second cylindrical portion **22** into a generally U-shaped cross-section so as to restore it into its initial shape.

At this time, since the wire harness is held or retained by the first cylindrical portion **21** through the filler, there is no fear that the wire harness, even if pulled in the left-hand direction (in the drawings), is disengaged from the first cylindrical portion **21**.

Then, as shown in FIG. **5**, the wire harness is further pulled in the left-hand direction (in the drawings), and at this time since the open end of the second cylindrical portion **22** is held against the car body panel **11**, the second cylindrical portion **22** begins to be deformed in such a manner that its inner peripheral surface, which is originally the outer peripheral surface, is inverted.

The groove **24** in the second cylindrical portion **22** is deformed into a generally triangular-shape, and the conical surface of the engagement portion **26** is pressed against the car body panel **11**, so that the flange portion **25**, reduced in diameter, is deformed into a tapering, cylindrical shape, and its end portion of a smaller diameter is guided into the mounting hole **12**.

As the grommet **10** is pulled through the mounting hole **12**, an external force to change the angle of projection of the flange portion **25** from the second cylindrical portion **22** is exerted on the flange portion **25**.

As shown in FIG. **6**, in this condition, when the wire harness is further pulled in the left-hand direction (in the drawings), the connection portion **23** is deformed into close

contact with the outer peripheral surface of the larger-diameter portion **28** so that the flange portion **25**, deformed into a cylindrical shape, can pass through the mounting hole **12**.

As a result, the flange portion **25** passes through the mounting hole **12**. At this time, the second cylindrical portion **22** is deformed to be spread toward the open end thereof, and therefore the engagement portion **26** is disengaged from the car body panel **11**, and the groove **24** is restored into a generally channel-shaped cross-section.

Thereafter, the wire harness is further pulled in the left-hand direction (in the drawings), and when the flange portion **25** is moved into a predetermined position, a high resilient force, tending to restore the angle of projection of the flange portion **25** from the second cylindrical portion **22** into the initial angle, is released.

Since the flange portion **25** is restored into its initial shape as shown in FIG. **7**, it passes through the mounting hole **12** to be spread, and therefore the grommet **10** moves left (in the drawings) by itself, and the groove **24** is fitted on the flange **13** of the mounting hole **12**.

In this grommet **10**, the plurality of guide portions **30** extend radially from the outer peripheral surface of the first cylindrical portion **21**, and therefore the second cylindrical portion **22** can be positively disposed coaxially with the mounting hole **12**, thereby eliminating the possibility that the groove **24** is not fitted properly to the mounting hole **12** with respect to the inner peripheral edge of the mounting hole **12**.

In this grommet **10**, each of the guide portions **30** has a plate-like shape, and is parallel to the central axis of the first cylindrical portion **21**, and therefore the guide portions can have a level of strength so that they will not be easily deformed and the first cylindrical portion **21** can be positively disposed coaxially with the mounting hole **12**.

In this grommet **10**, the guide portions **30** are interconnected through the disk portion **32** and the annular portion **33** which correspond to the mounting hole **12**, to further increase their strength.

Also, the guide portions **30** taper toward the open end of the first cylindrical portion **21**, and therefore can be easily fitted into the mounting hole **12**, and the first cylindrical portion **21** can be positively disposed coaxially with the mounting hole **12**.

In this grommet **10**, the engagement portion **26** is formed on the outer peripheral surface of the second cylindrical portion **22**, and is tapered from the groove **24** toward the open end of the second cylindrical portion **22**. Therefore, by fitting the inverted second cylindrical portion **22** on the flange **13** of the mounting hole **12**, the second cylindrical portion **22** can be disposed coaxially with the mounting hole **12**, and therefore the groove **24** can be fitted uniformly relative to the mounting hole **12**.

In the grommet **10**, the recesses **29** are formed radially on the end surface of the flange portion **25**, and therefore when the second cylindrical portion **22** is inverted, the flange portion **25** is reduced in diameter, that is, formed into a tapering cylindrical shape, while forming regular radial wrinkles on the flange portion **25**. Therefore, the open end of the second cylindrical portion **22** can be easily passed through the mounting hole **12**, and the efficiency of the operation can be enhanced as compared with the conventional construction.

In this grommet **10**, the flange portion **25** is formed continuously in the circumferential direction, and therefore a sufficient resilient force to restore the second cylindrical portion **22** into its initial shape develops in the flange portion **25**, and therefore the mounting operation can be carried out easily as compared with the conventional construction.

In this grommet **10**, since the sufficient resilient force can be produced in the flange portion **25**, the diameter of the flange portion **25** does not need to be substantially increased, and therefore the area of that portion of the car body **11**, occupied by this flange portion, can be made small.

In the grommet **10**, the recesses **29** are provided at that end surface of the flange portion **25** directed toward the connection portion **23**, and therefore the opposite end surface thereof is made flat, and with this construction, an unnecessary gap is not formed between this flange portion and the car body panel **11**, and therefore waterproof, sound-insulating and heat-insulating properties are not adversely affected.

Each of the recesses **29** in the flange portion **25** has a rectangular cross-section, and therefore the minimum thickness of the flange portion **25** can be made uniform, and when the second cylindrical portion **22** is inverted, the bottom surface **29**A of each recess **29** is bent or deformed into a mountain-like configuration, so that this flange portion is easily and positively reduced in diameter uniformly.

In this grommet **10**, the engagement portion **26** is formed on the outer peripheral surface of the second cylindrical portion **22**, and is tapered from the groove **24** toward the open end of the second cylindrical portion **22**. Therefore, by fitting the inverted second cylindrical portion **22** on the flange **13** of the mounting hole **12**, the second cylindrical portion **22** can be disposed coaxially with the mounting hole **12**, and therefore the groove **24** can be fitted uniformly relative to the mounting hole **12**.

FIGS. **8** to **10** show the second embodiment of the grommet **40** of the present invention.

In the embodiment to be described below, those portions, already described for FIGS. **1** to **7**, will be designated by identical or like reference numerals, respectively, and explanation thereof will be simplified or omitted.

Referring to FIGS. **8**(A) and **8**(B), grommet **40** includes a first cylindrical portion **41** for passing a wire harness therethrough, a connection portion **43** of a generally conical shape formed on an outer peripheral surface of the first cylindrical portion **41**, a second cylindrical portion **42** connected to the first cylindrical portion **41** through the connection portion **43**, a groove **24** formed in an outer peripheral surface of the second cylindrical portion **42**, a flange portion **25** formed on the outer peripheral surface of the second cylindrical portion **42**, and an engagement portion **26** formed on that portion of the outer peripheral surface of the second cylindrical portion **42** disposed adjacent to an open end thereof.

A smaller-diameter portion **47** and a larger-diameter portion **48** are continuous with each other along a common axis, and this grommet **40** differs from the first embodiment in that the smaller-diameter portion **47** is provided within the second cylindrical portion **42**.

In this grommet **40**, eight guide portions **50** extend radially from the outer peripheral surface of the first cylindrical portion **41**, and each of these guide portions has a plate-like shape, and is disposed parallel to the axis of the first cylindrical portion **41**. These guide portions **50** are spaced 45 degrees from one another in a direction of the circumference of the first cylindrical portion **41**.

These guide portions **50** have the same length in the radial direction, and are interconnected through a disk portion **52**

and an annular portion **53** which correspond to a mounting hole **12**. When the guide portions **50** are brought into contact with an inner peripheral edge of the mounting hole **12** through the annular portion **53**, the second cylindrical portion **42** is disposed coaxially with the mounting hole **12**.

In this grommet **40**, similar effects as those described above for the first embodiment can be achieved.

The third embodiment of the grommet **60** of the present invention, shown in FIG. **11**, has four guide portions **70** extending radially from an outer peripheral surface of a first cylindrical portion **21**. Each of the guide portions **70** has a plate-like shape, and is disposed parallel to the axis of the first cylindrical portion **21**. These guide portions **70** are spaced 90 degrees from one another in a direction of the circumference of the first cylindrical portion **21**, have respective chamfered portions **71** tapering or slanting toward an open end of the first cylindrical portion **21**.

These guide portions **70** have the same length in the radial direction, and are interconnected through a pair of disk portions **72**, **72** which correspond to a mounting hole **12**. The disk portions **72**, **72** are spaced a predetermined distance from each other along the axis of the first cylindrical portion **21**.

In this grommet **60**, when distal end surfaces **74** of the guide portions **70**, as well as peripheral surfaces **75** of the disk portions **72** and **72**, are brought into contact with an inner peripheral edge of the mounting hole (not shown), a second cylindrical portion **22** is disposed coaxially with this mounting hole.

In this grommet **60**, similar effects as those described above for the first and second embodiments can be achieved.

In this grommet **60**, since the guide portions **70** are interconnected through the pair of disk portions **72**, **72** spaced the predetermined distance from each other along the axis of the first cylindrical portion **21**, the strength of the guide portions **70** can be increased, and therefore the second cylindrical portion **22** can be positively positioned relative to the mounting hole.

In this grommet **60**, since the disk portions **72**, **72** are spaced the predetermined distance from each other along the axis of the first cylindrical portion **21**, the peripheral surfaces **75** of the disk portions **72**, **72** are disposed in an imaginary, common cylindrical surface.

Namely, in this grommet **60**, the peripheral surfaces **75** of the disk portions **72**, **72** perform substantially the same function as that of the annular portion, and therefore the provision of the annular portion, used in the first and second embodiments, can be omitted.

In the present invention, if four guide portions **90**, spaced 90 degrees from one another in a direction of a circumference of a first cylindrical portion **21**, have a sufficient strength to stand independently of each other, the provision of the disk portion and the annular portion may be omitted as in the fourth embodiment of the grommet **80** of the invention shown in FIG. **12**.

These guide portions **90** have respective chamfered portions **91** tapering or slanting toward an open end of the first cylindrical portion **21**, and distal end surfaces **94** of the guide portions **90**, and when distal end surfaces **74** of the guide portions **70** are brought into contact with an inner peripheral edge of the mounting hole (not shown), a second cylindrical portion **22** is disposed coaxially with this mounting hole.

In this grommet **80**, also, the desired effects can be achieved.

The present invention is not limited to the above embodiments, and various modifications and improvements can be made, and the material, shape, dimensions, configuration, number, mounting position and etc., for the mounting plate, the mounting hole, the first cylindrical portion, the connection portion, the second cylindrical portion, the groove, the flange portion, the engagement portion, the guide portions, the disk portion, the annular portion and so on are arbitrary, and are not limited in so far as the present invention can be achieved.

As described above, in the present invention, the plurality of guide portions extend radially from the outer peripheral surface of the first cylindrical portion, and therefore the second cylindrical portion can be positively disposed coaxially with the mounting hole, so that the groove will not be improperly fitted on the inner peripheral edge of the mounting hole.

In the present invention, each of the guide portions has a plate-like shape, and is disposed parallel to the axis of the first cylindrical portion. Therefore, the guide portions can have the required strength, and will not be easily deformed so that the first cylindrical portion can be positively disposed coaxially with the mounting hole.

In the present invention, the guide portions are interconnected through the disk portion, or are interconnected through the annular portion, and therefore the strength can be further increased.

In the present invention, the guide portions are tapered toward the open end of the first cylindrical portion, and therefore the guide portions can be easily inserted into the mounting hole, and the first cylindrical portion can be positively disposed coaxially with the mounting hole.

In the present invention, the engagement portion is formed on the outer peripheral surface of the second cylindrical portion, and is tapered from the groove to the distal end of the second cylindrical portion. Therefore, when the inverted second cylindrical portion is fitted on the flange of the mounting hole, the cylindrical portion can be held coaxially with the mounting hole.

What is claimed is:

1. A grommet for passing and holding a member relative to a mounting hole formed in a mounting plate, comprising:

a first cylindrical portion which is adapted to receive the member therethrough;

a second cylindrical portion, connected to said first cylindrical portion by an annular connection portion, which is formed on an outer peripheral surface of said first cylindrical portion;

a groove portion formed in an outer peripheral surface of said second cylindrical portion;

a flange portion formed on a portion of the outer peripheral surface of said second cylindrical portion located between said groove portion and said connection portion; and

a plurality of guide portions which extend radially from the outer peripheral surface of said first cylindrical portion, wherein said plurality of guide portions contact an inner peripheral edge of said mounting hole to coaxially dispose said second cylindrical portion with said mounting hole,

wherein an inner peripheral surface of said second cylindrical portion is directed outwardly, and a peripheral edge portion of said flange portion is adapted to be inserted into said mounting hole and said first cylindrical portion is adapted to be passed through said

mounting hole, and said second cylindrical portion is restored to an initial shape, so that said groove portion of said second cylindrical portion is adapted to be fitted on an inner peripheral edge of said mounting hole.

2. A grommet according to claim **1**, wherein each of said guide portions has a plate-like shape, and is disposed on a plane parallel to a central axis of said first cylindrical portion.

3. A grommet according to claim **2**, wherein said guide portions are interconnected through a disk portion, wherein said disk portion corresponds in size to said mounting hole.

4. A grommet according to claim **2**, wherein said guide portions are interconnected through an annular portion, wherein said annular portion corresponds in size to said mounting hole.

5. A grommet according to claim **2**, wherein said guide portions are tapered toward an open end of said first cylindrical portion, so as to fit easily through said mounting hole.

6. A grommet according to claim **2**, wherein said guide portions are interconnected through a pair of disk portions having a diameter size which corresponds to a diameter of said mounting hole, wherein a peripheral surface of each of said pair of disk portions contact an inner peripheral edge of said mounting hole to coaxially dispose said first cylindrical portion with respect to said mounting hole.

7. A grommet according to claim **1**, wherein an engagement portion is formed on the outer peripheral surface of said second cylindrical portion, and is tapered from said groove portion to a distal end of said second cylindrical portion, wherein said engagement portion contacts the mounting plate as said flange portion is inserted into said mounting hole.

8. A grommet according to claim **1**, wherein a plurality of radially extending recesses are arranged on said flange and extend toward said annular connection portion, each of said plurality of recesses having a rectangular cross-section defined by a bottom surface and a pair of wall surfaces, wherein the walls of the recesses move toward each other and the bottom surface deforms, when the inner peripheral surface of the second cylindrical portion is directed outwardly.

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